

Affect of Lipid Antioxidants on the Stability of Meat during Storage

Robert C. Benedict,* Elizabeth D. Strange, and Clifton E. Swift

Deteriorative changes in meat may occur from heme and lipid oxidations, producing alterations in color, flavor, and odor. Samples of ground beef with either low levels (*ca.* 3%) or high levels (*ca.* 10%) of polyunsaturation in the added fat were examined for storage produced changes. High polyunsaturation levels increased meat deterioration. The antioxidant effectiveness of five additives (0.005% level) derived from natural sources (α -tocopherol, ascorbic acid, 1-ascorbyl stearate, citric acid, and ascorbic acid with sodium bicar-

bonate) was examined during 10 days storage. Samples were adjudged to be commercially unacceptable after 1-4 days storage but monitoring was continued to determine differences in the additive's antioxidant action. Ascorbic acid exerted a definite prooxidant action. The other additives showed only a slight effect in decreasing the rate of lipid and heme oxidations compared to untreated samples. A hypothesis of coupled heme-lipid oxidation is presented.

Generally, the oxidation of lipids in foods is undesired as it may lead to alterations in flavor, odor, and color. The reactivity of fats and other lipids with oxidants within a biological system can vary markedly from the reactivity of extracted and purified lipids. Such factors as the degree of lipid unsaturation, the content of prooxidants and antioxidants, and the cellular and tissue structure all contribute to these differences in oxidation rate (Ledward and MacFarlane, 1971; Love and Pearson, 1971; Kwoh, 1971; Sato and Herring, 1973). With fresh meats, deteriorative changes resulting from oxidation of lipids have not

been a major problem to date. Most spoilage in fresh meat occurs as a result of bacterial action, producing an acid odor and flavor and a brown color. The aerobic bacteria on the meat surface and the endogenous reductants within the tissue act to diminish the oxygen available for tissue lipid oxidations (DeVore and Solberg, 1974). In addition, beef fat is not highly polyunsaturated, with beef adipose tissue lipid containing only about 2.5% polyunsaturates (Swern, 1964). In the more unsaturated pork fat (10-12% polyunsaturates, Swern, 1964), the lipid oxidation is limited somewhat by the lower levels of the prooxidant heme pigments, myoglobin and hemoglobin. Fresh pork, however, does have a limited shelf and storage life, even in frozen storage, because of the development of oxidative rancidity and off-flavors.